

Claim Listing:

Claims 1-41 (Cancelled)

42. (Withdrawn) Device for carrying out the procedure according to claim 1 having an electron beam generating electron beam column with a control device to switch between predetermined positions delivering different power for said electron beam generating electron beam column and insofar different intensities of said beams of electrons.

43. (Canceled)

44. (Withdrawn) Device according to claim 42, characterized in that said control device further controls deflection means for the different beam of electrons.

45. (New) Procedure for etching a sample, said sample comprising a material and having a surface, by focussed electron beam induced chemical reaction at said surface and in a portion of said material, comprising the steps of:

a. providing an electron beam column capable of generating a focussed electron beam,

b. feeding, in a vacuum atmosphere, molecules of a reaction gas to said surface of said sample,

c. irradiating said surface, said portion of material of said sample to be etched and said molecules of said reaction gas in said vacuum atmosphere with at least one first beam of electrons; said surface, said portion of said material to be etched and said

molecules of said reaction gas undergo a chemical reaction forming a reaction product which is not gaseous and not volatile, said reaction product having a vaporisation temperature and a sublimation temperature, and

d. irradiating said reaction product with a second electron beam which heats said reaction product and said material locally above at least one of said vaporisation temperature and said sublimation temperature to remove said reaction product from said surface.

46. (New) Procedure for etching a sample, said sample comprising a material and having a surface, by focussed electron beam induced chemical reaction at said surface and in a portion of said material, comprising the steps of:

- a. providing an electron beam column capable of generating a focussed electron beam,
- b. feeding, in a vacuum atmosphere, molecules of a reaction gas to said surface of said sample,
- c. irradiating said surface, said portion of material of said sample to be etched and said molecules of said reaction gas in said vacuum atmosphere with at least one first beam of electrons; said surface, said portion of said material to be etched and said molecules of said reaction gas undergo a chemical reaction forming a reaction product which is not gaseous and not volatile, said reaction product having a vaporisation temperature and a sublimation temperature, and

d. irradiating said reaction product with a second electron beam which heats said reaction product and said material locally above at least one of said vaporisation temperature and said sublimation temperature to remove said reaction products from said surface; wherein said first electron beam and said second electron beam are generated by different settings of said same electron beam column.

47. (New) Procedure of claim 46, wherein said electron beam column comprises several beam limiting apertures and wherein said different settings of said electron beam column are created by passing said electron beam column through different ones of said several beam limiting apertures.

48. (New) Procedure of claim 47, wherein a selection between individual ones of said several beam limiting apertures is performed electrically by deflection fields.

49. (New) Procedure for etching a sample, said sample comprising a material and having a surface, by focussed electron beam induced chemical reaction at said surface and in a portion of said material, comprising the steps of:

- a. providing an electron beam column capable of generating a focussed electron beam,
- b. feeding, in a vacuum atmosphere, molecules of a reaction gas to said surface of said sample,
- c. irradiating said surface, said portion of material of said sample to be etched and said molecules of said reaction gas in said vacuum atmosphere with at least one first

beam of electrons; said surface, said portion of said material to be etched and said molecules of said reaction gas undergo a chemical reaction forming a reaction product which is not gaseous and not volatile, said reaction product having a vaporisation temperature and a sublimation temperature,

d. irradiating said reaction product with a second electron beam which heats said reaction product and said material locally above at least one of said vaporisation temperature and said sublimation temperature to remove said reaction product from said surface; wherein said second beam of electrons has a higher intensity than said first beam of electrons.

50. (New) Procedure according to claim 49, wherein said second electron beam provides an electron current in the range between 1 and 20 nA.

51. (New) Procedure of claim 50, wherein said electron beam column comprises several beam limiting apertures and wherein different settings of said electron beam column are created by passing said electron beam column through different ones of said several beam limiting apertures.

52. (New) Procedure of claim 51, wherein a selection between individual ones of said several beam limiting apertures is performed electrically by deflection fields.

53. (New) Procedure of claim 49, wherein said first electron beam is irradiated to said surface of said sample in a focussed manner and wherein said second beam of electrons is irradiated to said surface of said sample in a defocused manner compared to said focussing of said first electron beam.

54. (New) Procedure of claim 53, wherein said electron beam column comprises several beam limiting apertures and wherein in different settings of said electron beam column are created by passing electron beam column through different ones of said several beam limiting apertures.

55. (New) Procedure of claim 54, wherein a selection between individual ones of said several apertures is performed electrically by deflection fields.

56. (New) Procedure according to claim 55, wherein said second electron beam provides an electron current in the range between 1 and 20 nA.

57. (New) Procedure according to claim 45 wherein said second beam of electrons is generated in a pulsed and/or focussed way.

58. (New) Procedure according to claim 46 wherein said second beam of electrons is generated in a pulsed and/or focussed way.

59. (New) Procedure according to claim 49 wherein said second beam of electrons is generated in a pulsed and/or focussed way.

60. (New) Procedure according to claim 45 wherein said surface of said sample to be etched is initially cleaned by thermal desorption with electron beam heating.

61. (New) Procedure according to claim 46 wherein said surface of said sample to be etched is initially cleaned by thermal desorption with electron beam heating.

62. (New) Procedure according to claim 49 wherein said surface of said sample to be etched is initially cleaned by thermal desorption with electron beam heating.

63. (New) Procedure according to claim 45 wherein said surface of said sample has carbon contamination thereon and wherein the initial step is: reacting excited halogen atoms released by a beam of molecules comprising water, hydrogen peroxide, chlorine and other halogen compounds with said carbon contamination to effect cleaning of said surface of said sample.

64. (New) Procedure according to claim 45 wherein said surface of said sample has silicon oxide contamination thereon and wherein the initial step is reacting excited halogen atoms released by a beam of molecules comprising chlorine or other halogen compounds with said silicon oxide contamination under irradiation with a third electron beam to effect cleaning of said surface of said sample, said third electron beam generated is a different aperture setting over said first and second beams of electrons.

65. (New) Procedure according to claim 63 comprising a fourth beam of electrons and wherein a reaction product is formed by said reaction between said carbon contamination and said beam of molecules which is not gaseous and which is not volatile is evaporated by heating with said fourth beam of electrons to heat said surface of said sample to a temperature above the vaporization temperature of said reaction product, said fourth electron beam generated in a different aperture setting over said first and second beams of electrons.

66. (New) Procedure according to claim 45 wherein said at least one beam of molecules includes selected chemical compounds in a stoichiometric composition issued

from a gas feeding system to said surface of said sample during said step of irradiating said surface, said portion of material of said sample to be etched, and said molecules of said reaction gas in said vacuum atmosphere with said at least one first beam of electrons.

67. (New) Procedure according to claim 45 wherein said molecules of said reaction gas are issued with a multi-jet supply that contains a catalyst to enhance the reaction.

68. (New) Procedure for etching a sample, said sample comprising a material and having a surface, by focussed electron beam induced chemical reaction at said surface and in a portion of said material, comprising the steps of:

- a. providing an electron beam column capable of generating a plurality of focussed electron beams using different apertures;
- b. heating said sample with a first electron beam with relatively high current to clean said surface of said sample and desorb adsorbates;
- c. generating adsorption sites for molecules of a reaction gas with a second electron beam scan;
- d. feeding, in a vacuum atmosphere, molecules of a reaction gas to said surface of said sample,
- e. irradiating said surface, said portion of material of said sample to be etched and said molecules of said reaction gas in said vacuum atmosphere with at least one third beam of electrons; said surface, said portion of said material to be etched and said molecules of said reaction gas undergo a chemical reaction forming a reaction product which is not

gaseous and not volatile, said reaction product having a vaporisation temperature and a sublimation temperature; and

f. irradiating said reaction product with a fourth electron beam which is a pulsed high power beam which heats said reaction product and said material locally above at least one of said vaporisation temperature and said sublimation temperature to remove said reaction products from said surface; wherein said first, said second and said third electron beams are generated by different settings of said same electron beam column.